NAVAJO SUPERFUND OFFICE

NAVAJO - BROWN VANDEVER URANIUM MINE

PRELIMINARY ASSESSMENT REFERENCES

JUNE '90 P. MOLLOY

LEONARD HASKIE
INTERIM PRESIDENT
NAVAJO NATION

THE NAVAJO NATION

IRVING BILLY
INTERIM VICE PRESIDENT
NAVAJO NATION

NSO-90-62

April, 06 1990

Mark Satterwhite
Superfund Indian Coordinator
U.S. EPA Region VI
1445 Ross Avenue
Dallas, Texas 75202

Dear Mr. Satterwhite:

Enclosed is the Preliminary Assessment (PA) Package for the Brown Vandever Uranium Mine, located near Bluewater, New Mexico. This report receives NSO internal approval and is now ready for your review and comment.

Please call myself or Patrick Molloy, the Health Physicist who prepared the package, for any questions you may have regarding the report. We would appreciate a response in the form of comments or approval at your earliest convenience. You may reach myself or staff at (602) 871-6859, 6860 or 6861.

Sincerely,

Clara Bia
Navajo Superfund Director

Enclosures

cc: Peter Sam, William Taylor, Superfund Site Assessment Section
Deborah Vaughn-Wright

PRELIMINARY ASSESSMENT FOR THE NAVAJO - BROWN VANDEVER URANIUM MINE

BY

PATRICK MOLLOY
HEALTH PHYSICIST, NAVAJO SUPERFUND OFFICE

SUMMARY

The Brown Vandever Mine contains about 1880 tons of uranium mine tailings abandoned on-site. Small quantities of ore grade material are to be found scattered all over the site. The material is uncovered and easily accessible by site residents and visitors. There are several uncovered ventilation shafts, timbered shafts and inclined adits on the site. There are no warning signs or fences preventing access to the site.

The population affected directly by the site is at least 75 people, and could be as high as 500 people. Over thirty children are known to play on the tailings and in the immediate vicinity of the mine.

There is a haulage road on the site "paved" with tailings. Radiometric evidence indicates off-site migration of contaminants at least 2 mi from this road via automobiles driven on this road by area residents.

MAJOR CONCLUSIONS

The site has a status of immediately dangerous to life and health.

Immediate action is recommended.

PRELIMINARY ASSESSMENT

DATE : May 20, 1990

Prepared by: Patrick Molloy, Health Physicist, Navajo Superfund Office

Site : Navajo - Brown Vandever Uranium Mine

EPA ID # : Not assigned

SITE INFORMATION

Site Location. The Brown Vandever Uranium Mine (Brown Uranium Mine, sic)is located approximately 4 miles east of Prewitt, New Mexico. The site is also located approximately 20 miles north-northwest of Grants, New Mexico (figure# 1). The site may be found by proceeding east from the Prewitt, New Mexico post office on the Interstate 40 frontage road approximately 1 mile and subsequently traveling east on an improved dirtroad for approximately 5 miles (figure #2). The road turns north at the eastern edge of Haystack mountain, a prominent geological feature in the area. The site is located on the southeastern margin of Haystack mountain approximately 1 mile north of El Tintero cinder cone (figure #2). The Geographic coordinates for the site are 35° 21' 02" N latitude and 107°56'25" W longitude (7).

The mine is located on an expired mining claim of approximately ¼ section in area. Approximately 65 persons, including small childern live on-site in a semi-agricultural rural setting (3,4; worksheet #2, 7). Two inclined adits, an almost vertical timbered shaft, two vertical ventilation shafts and a strip mine covering approximately 100 acres are notable features of the abandoned claim (3; Frames).

OWNER AND OPERATOR. The Brown Vandever Mine is currently owned, and was owned throughout its history by the Navajo Nation (17). The land is held in trust for the Navajo Nation by the Federal Government through the authority of the Bureau of Indian Affairs (BIA).

The primary lease holders for the claim were variously; Williams and Thompson (full names not found) and Mr. Brown Vandever (2;pg 1-276, 3-5). The site was presumably subleased to the various operators (2; page 3-5). Several other mines are to be found in the area the most notable being the Haystack 2 mine (11). The lease is currently owned by the Navajo Nation (17).

PURPOSE OF INVESTIGATION The Brown Vandever Uranium Mine was reported to be a potentially contaminated waste site by the Navajo Superfund office field reconnaissance team in 1990 (1).

SITE HISTORY The Brown Vandever Uranium Mine is located in the Ambrosia Lake sub-district of the Grants Mining District (7,10). No Historical record for naturally occuring radiation levels for the area has survived until the present. Two inclined adits were driven north-northwestward into the dip of the Todilto formation (3;frame #12, figure #4). These inclines were reported to be approximately 300 ft. deep (14; page #6, direct quote): additionally, two 400 yd. drifts were driven into the ore bodies associated with the incline in Frame #12 (14; page #2).

A timbered shaft inclined at approximately 10° from the vertical, was driven into the dip of the Todilto formation approximately 1000 ft. west of the inclined adits (3; frame #33). This shaft was reported to be approximately 300 ft. deep (14; page #6): drifts were also excavated northwest and northeast from the shaft.

Two, two-foot diameter vertical shafts were excavated between the inclined adits and the timbered shaft in order to provide ventilation for the mining operation (3; frame #33); the ventilation shafts were reported to be approximately 300 ft. deep (Mr. Brown Vandever, personal communication, April 11, 1990).

The area south of the inclined adits has been extensively strip-mined: The area of surface disturbances has been estimated to be approximately 100 acres in extent (4; page # 8, Figure #2). Tailings associated with the N. and B. Vandever Mines were used to "pave" a road leading to the N. Vandever works.

It is presumed that the mining operation was carried out using conventional mining techniques; Due to the extensive and elaborate nature of the surface works and adits (shafts), it is unlikely that manual labor was utilized to any great degree. A powerline extension which was used to provide electricity for an air compressor still exists on site.

The Brown Vandever Uranium Mine was operated intermitently over the period of years from 1952 until 1966 (2). Santa Fe Uranium, Federal Uranium Mesa Mining Co. and Cibola Mining Co. were some of the mining interests involved: Other individuals operated the mine (2).

Mining operations at the site produced 25,796 tons of ore rich in Uranium (U_3O_8,0.) 0.19% grade) and Vanadium (V_2O_5, 0.30% grade). A total of 98,175 lbs of U_3O_8 and 75,342 lbs of V_2O_5 were milled from the raw production tonnage (2, pg# 1-276, 3-5).

It is presumed that the ore was transported to Shiprock, New Mexico or Durango, Colorado for milling. However, no record of where the milling took place was found: It is not known whether the Phillips Petroleum Ambrosia mill was in operation during the time the ore was being produced.

DISSCUSSION OF KNOWN/POTENTIAL PROBLEMS During a windshield survey of the site and environs, in order to ascertain population, population distribution, water usage patterns and area radiometric background

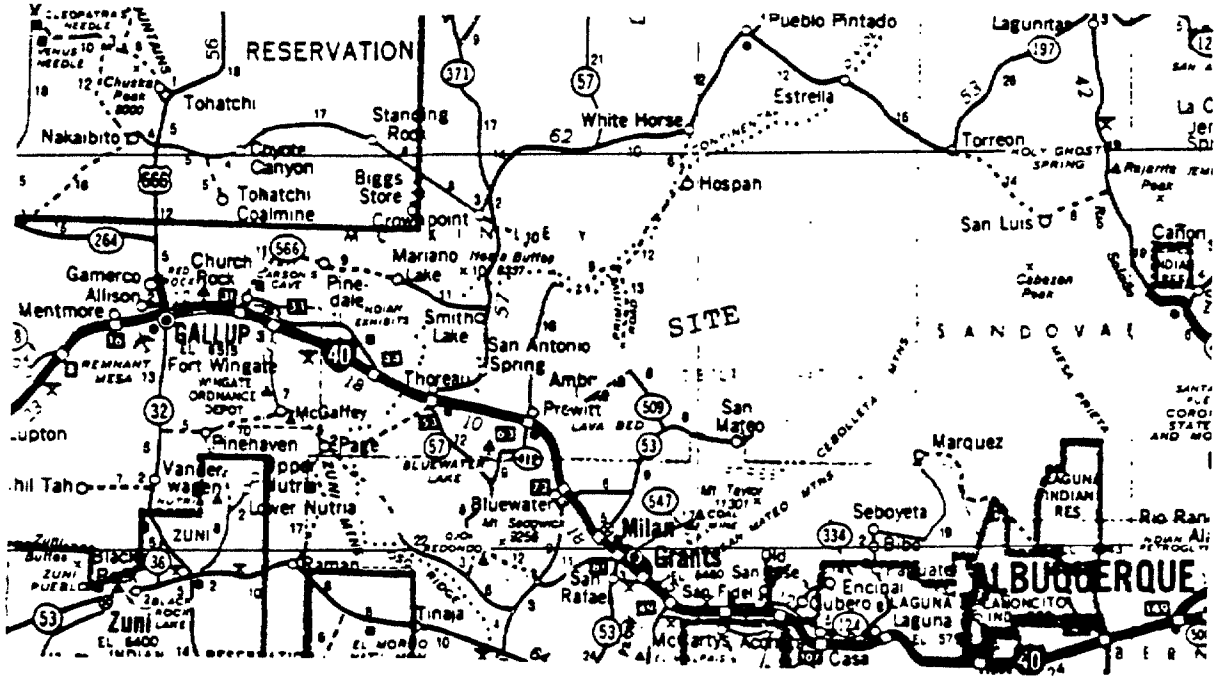

FIGURE # 1 ; REPRINTED BY PERMISSION

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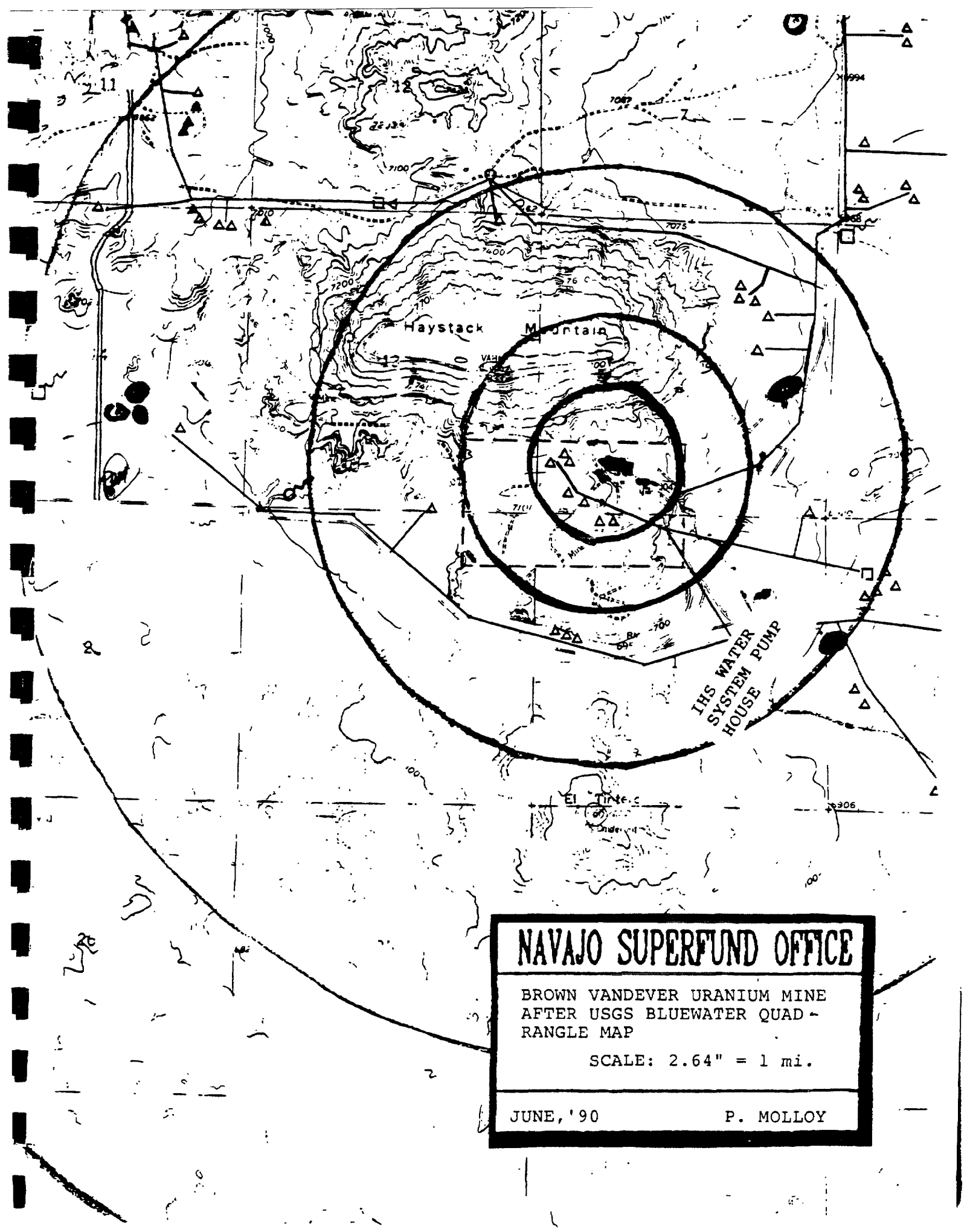
NAVAJO-BROWN VANDEVER URANIUM MINE

JUNE, '90 P. MOLLOY


Haystack Mountain
IHS WATER SYSTEM PUMP HOUSE
NAVAJO SUPERFUND OFFICE
BROWN VANDEVER URANIUM MINE
AFTER USGS BLUEWATER QUADRANGLE MAP
SCALE: 2.64" = 1 mi.
JUNE,'90
P. MOLLOY

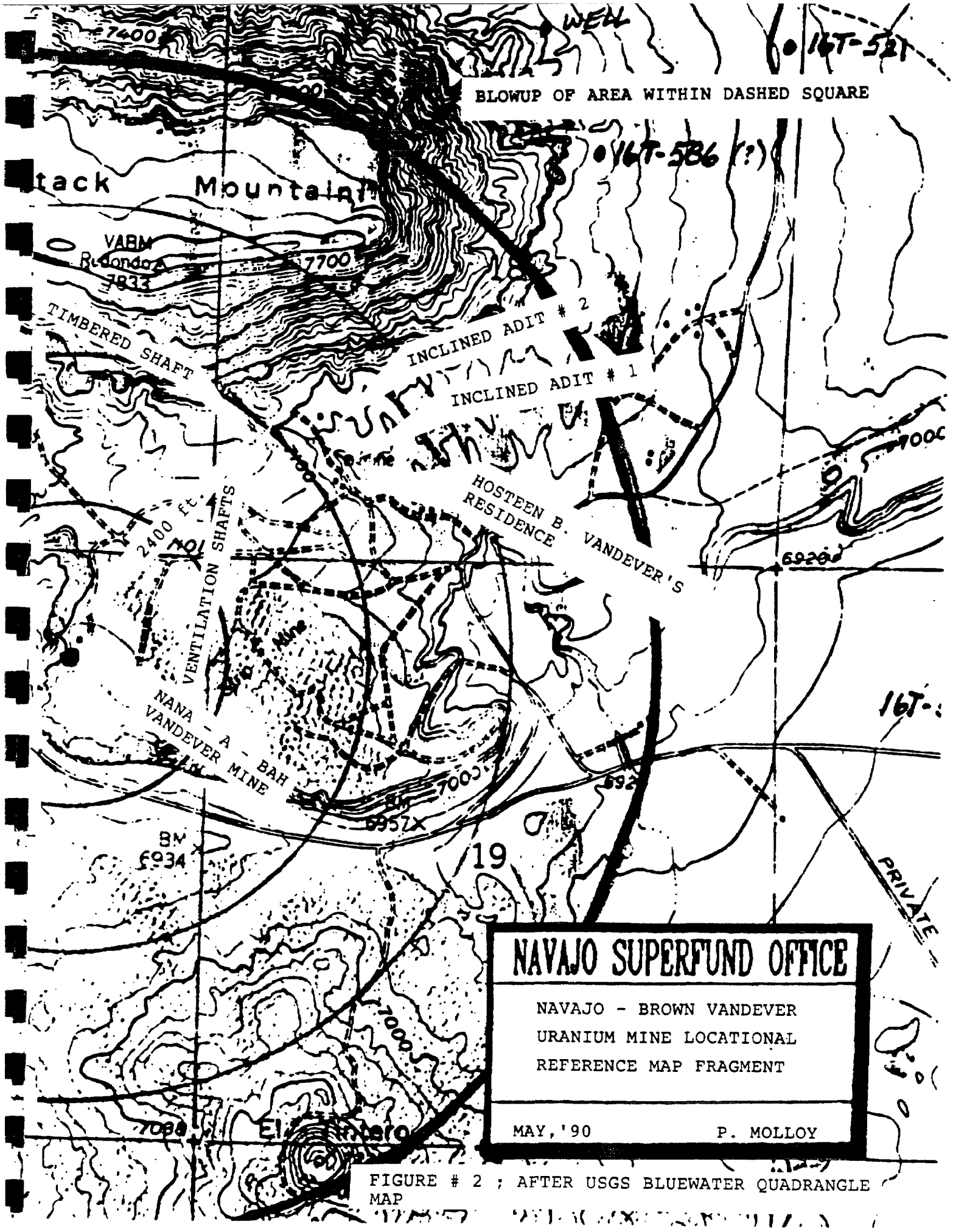
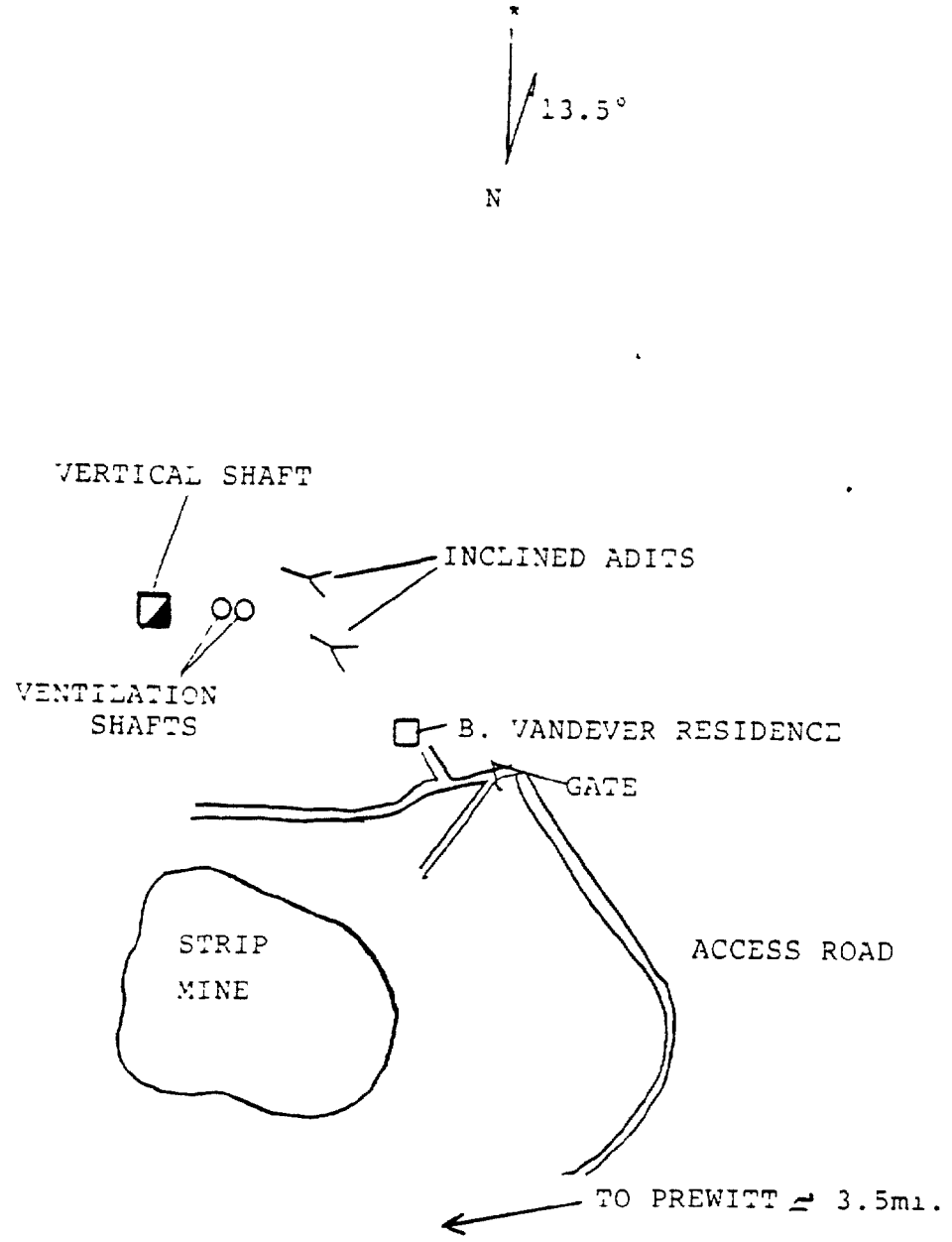


FIGURE # 2 ; AFTER USGS BLUEWATER QUADRANGLE MAP



SCALE - 1" ≃ 1418 ft.

FIGURE - 4 ; SITE SKETCH

NAVAJO SUPERFUND OFFICE
NAVAJO-BROWN VANDEVER URANIUM MINE SITE SKETCH
JUNE,'90 P. MOLLOY

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

DATE APRIL 11, 1990 **TIME** 10:20am **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 20° ENE

FILM TYPE POLAROID **FRAME NO.** 5

DATA TAKEN WITH PHOTOGRAPH: NONE

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey ( )
   Reading:_____
5. Deep Well Water Sample ( )
6. Photograph Below: YES

SITE

7. DESCRIPTION HAYSTACK BUTTE, REFERENT, LOOKING E OF ENE

PIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

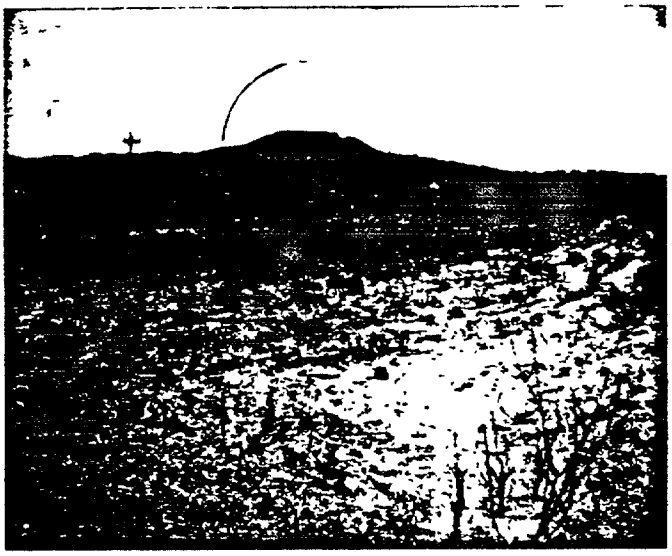
DATE APRIL 11,1990 **TIME** AFTERNOON **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 270 / S

FILM TYPE POLAROID **FRAME NO.** 20'

DATA TAKEN WITH PHOTOGRAPH: *** NONE ***

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey ( )
   Reading:_____
5. Deep Well Water Sample ( )
6. Photograph Below: YES



~50' FR. (EL TINTERO CINDER CONE, REF. 1)

7. **DESCRIPTION** EL TINTERO CINDER CONE BEHIND, LOOKING S

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

DATE APRIL 11,1990 **TIME** 10:25am **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 20° ENE

FILM TYPE POLAROID **FRAME NO.** 7

DATA TAKEN WITH PHOTOGRAPH: YES

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey (X)
   Reading: LUDLUM#19-24uR.hr^{-1} :: ESP-II - 2.2(10^4)
5. Deep Well Water Sample ( ) BACKGROUND @ B VANDEVER
6. Photograph Below: YES

7th FIR.

7. **DESCRIPTION** TRENCH CUT NNE OF B. VANDEVER RESIDENCE. LOOKING NE. NOTE FRAMES 8, 9, 10 TAKEN AT SAME LOCATION

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

DATE APRIL 11,1990 **TIME** 10:25am **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 10° W OF NNE

FILM TYPE POLAROID **FRAME NO.** 15

DATA TAKEN WITH PHOTOGRAPH: YES

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading: _____
4. Radiation Survey (X)
   Reading: 350uR/hr-1(LUDLUM=19) : @ EDGE OF "LOADING BAY"
5. Deep Well Water Sample ( )
6. Photograph Below: YES

15TH FR.

7. DESCRIPTION TRENCH AT CENTER MIDDLEGROUND IS ORE "LOADING BAY", LOOKING N OF NNE

levels, the following observations were made;

* The population distribution is closely correlated with the Indian Health Service (IHS) water system (tautological).

* Several windmills in the area are no longer in service. At least one windmill shows infrequent use (18; pg #1).

* There are 7 residences on site: not all these residences are connected to the IHS water system.

* The old haulage road (for ore transport) is plainly visible and shows definite erosion: The road that obtains access to the site was at one time the haulage road. There is radiometric evidence that contaminants are migrating off site (18, pg #2).

* A drainage which trends east from the site exhibits radiometric readings consistent with contaminant transport/migration.

* The onsite haulage road was "paved" with mine tailings and provides a receptacle for mechanical transport of contaminants. An Eberline Gamma Ratemeter registered 10^3 cpm at the edge of the road (3; frame #22, 14; page #4) There is radiometric evidence of mechanical (eg, vehicle) transport of contaminants approximately 2 mi. from the site environs via the haulage road (18; page #2)

* The timbered shaft retains a shack at its mouth, however, access to the shaft can easily be gained by removing a wire grate covering the portal (3: Frame #33). Additionally, the shaft "aspirates" under certain meteorological conditions, contributing to the area Radon burden.

* The vertical ventilation shafts are poorly capped and young children in the area could easily gain access to the excavations (3; Frame #33).

* One inclined adit is used for waste disposal (3; Frame #12).

* Small quantities of ore grade material are to be found almost anywhere on site.

* Approximately 1880 tons of tailings materials are presently onsite. The material is uncovered and accessible (3.; Frames #8, #13, #15, #19, Frames #25 through #32).

* The Navajo Superfund Office FIT digilert alerted (enabled) inside the vehicle being used for reconnaissance at one point along the "Hot Road" (3; Frame #22): enable/alert on the device is set at .098 mR.hr-1.

Tailings material, the inclined adits and the timbered shaft are suspected of producing a leachate rich in toxic heavy metals and radioactive contaminants (4,11,23). Radiometric readings taken during

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

DATE APRIL 11,1990 **TIME** 11:15am **WEATHER** CLEAR TO SLIGHTLY OVERCAST

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 180° W

FILM TYPE POLAROID **FRAME NO.** 16'

DATA TAKEN WITH PHOTOGRAPH: YES

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey (X)
   Reading: SEE BELOW IN DESCRIPTION
5. Deep Well Water Sample ( )
6. Photograph Below: YES , EXTRA FRAME

16TH FR.
MOUTH OF DRAINAGE

7. **DESCRIPTION** MOUTH OF DRAINAGE, TAILINGS PILE ON RIGHT, ESP-II READINGS: @MOUTH - $5(10^4)$; @MIDWAY PAST TAILING - $6.5(10^4)$; @END OF TAILINGS - $3.25(10^4)$; ALL READINGS IN cpm., LOOKING W

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

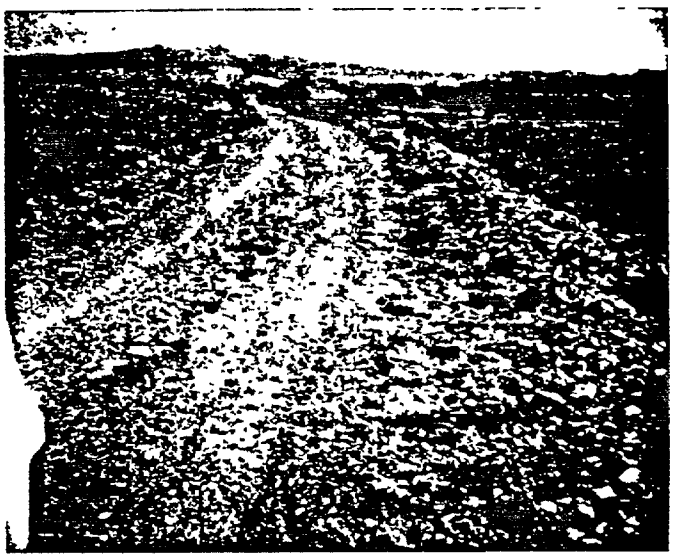
DATE APRIL 11,1990 **TIME** AFTERNOON **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 0° E

FILM TYPE POLAROID **FRAME NO.** 22

DATA TAKEN WITH PHOTOGRAPH: YES

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey (X)
   Reading: 105cpm/TSP-II @ EDGE OF ROAD
5. Deep Well Water Sample ( )
6. Photograph Below: YES



7. **DESCRIPTION** "HOT ROAD" WEST OF B. V. RESIDENCES, SURFACE WORKS WASTE PILES @ RIGHT MIDDLEGROUND, MT. TAYLOR @ UPPER LEFT BACKGROUND AS REFERENT

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE USEPA SITE NO. ~~NOT ASSIGNED~~

DATE APRIL 11,1990 TIME AFTERNOON WEATHER CLEAR TO SLIGHTLY OVERCAST

PHOTOGRAPHER P. MOLLOY ANGLE/DIRECTION 135° NW

FILM TYPE POLAROID FRAME NO. 33

DATA TAKEN WITH PHOTOGRAPH: YES

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading: _____
4. Radiation Survey (X)
   Reading: 10uR.hr^{-1}(LUDLUM=19), 10^4cpm(ESP-II) @ WEST FACE OF SHACK
5. Deep Well Water Sample ( )
6. Photograph Below: YES

33 @ ER.

7. DESCRIPTION B. VANDEVER TIMBERED SHAFT, SHAFT AT AN INCLINATION OF 10° FROM VERTICAL, CIRCULAR APERTURE ON S FACING WALL IS WIRED OVER BUT WIRE IS EASILY REMOVED, SHAFT ASPIRATES, "300 FT. DEEP" B. V. TO P. MOLLOY, APRIL 11,1990

PM

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

DATE APRIL 11,1990 **TIME** AFTERNOON **WEATHER** CLEAR TO SLIGHTLY OVERCAST

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** 250° WNW

FILM TYPE POLAROID **FRAME NO.** 33

DATA TAKEN WITH PHOTOGRAPH: *** NONE ***

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey (X)
   Reading:_____
5. Deep Well Water Sample ( )
6. Photograph Below: YES

33 FR.
(VERT. SH. VERTICAL !)

7. **DESCRIPTION** VERTICAL VENTILATION SHAFTS(2), HOSTEEN BROWN VANDEVER AT RIGHT MIDDLEGROUND, SHAFTS "300 FT. DEEP" - B. V. TO P. MOLLOY, APRIL 11,1990, LOOK-WNW

FCH

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

DATE APRIL 11,1990 **TIME** 10:25am **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** [illegible]

FILM TYPE POLAROID **FRAME NO.** 12

DATA TAKEN WITH PHOTOGRAPH: YES

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading: _____
4. Radiation Survey (X)
   Reading: LUDLUM=19 - 21uR.hr^{-1} : @ FACE OF ADIT
5. Deep Well Water Sample ( )
6. Photograph Below: YES

FR.

7. DESCRIPTION INCLINED ADIT N OF B. VANDEVER RESIDENCE, LOOKING NNW

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

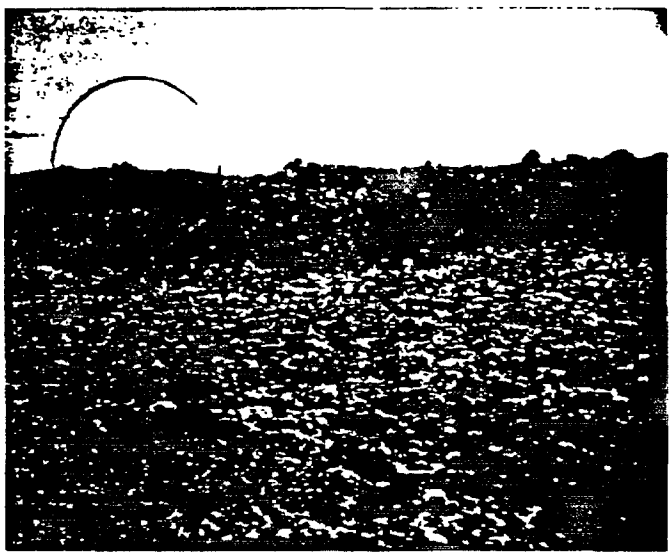
DATE APRIL 11,1990 **TIME** AFTERNOON **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** [illegible]

FILM TYPE POLAROID **FRAME NO.** 26

DATA TAKEN WITH PHOTOGRAPH: *** NONE ***

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey (X)
   Reading:_____
5. Deep Well Water Sample ( )
6. Photograph Below: YES



26TH FR

7. **DESCRIPTION** SURFACE WORKS WSW OF B. V. RES., LOOKING E OF ESE; NOTE MT. TAYLOR IN FAR LEFT BACKGROUND AS REFERENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

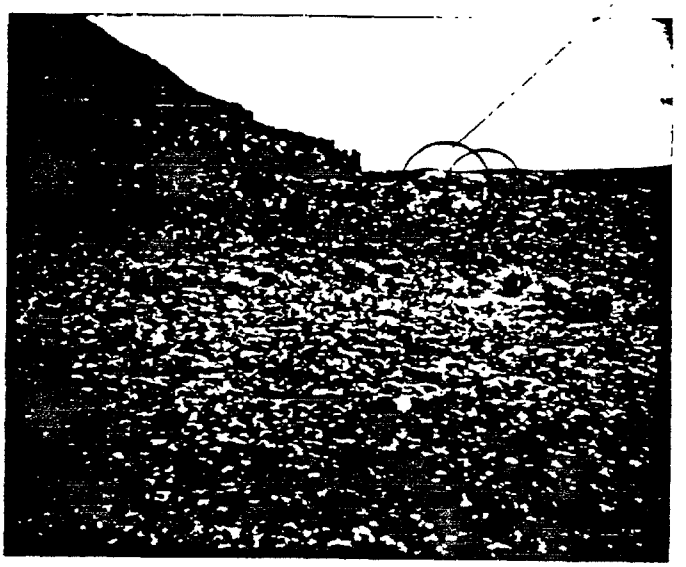
DATE APRIL 11,1990 **TIME** _____ **WEATHER** CLEAR

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** _____

FILM TYPE POLAROID **FRAME NO.** 28

DATA TAKEN WITH PHOTOGRAPH: *** NONE ***

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading: _____
4. Radiation Survey (X)
   Reading: _____
5. Deep Well Water Sample ( )
6. Photograph Below: YES, SEE SKETCH



28 = FT.

7. DESCRIPTION SEE SKETCH

NAVAJO SUPERFUND DEPARTMENT

FIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

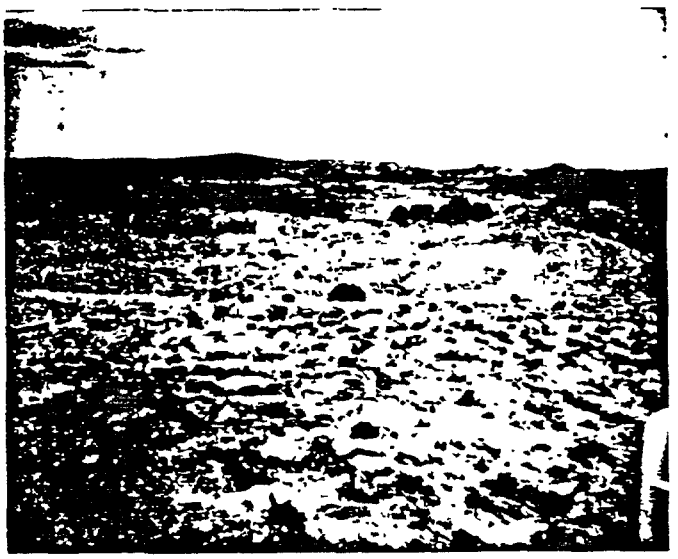
DATE APRIL 11,1990 **TIME** 11:15am **WEATHER** CLEAR TO SLIGHTLY OVERCAST

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** SEE SKETCH

FILM TYPE POLAROID **FRAME NO.** 31

DATA TAKEN WITH PHOTOGRAPH:

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading:_____
4. Radiation Survey (X)
   Reading:_____
5. Deep Well Water Sample ( )
6. Photograph Below: YES



SHEEP.

7. DESCRIPTION _____

NAVAJO SUPERFUND DEPARTMENT

PIT PHOTOGRAPH LOG SHEET

SITE NAME BROWN VANDEVER URANIUM MINE **USEPA SITE NO.** NOT ASSIGNED

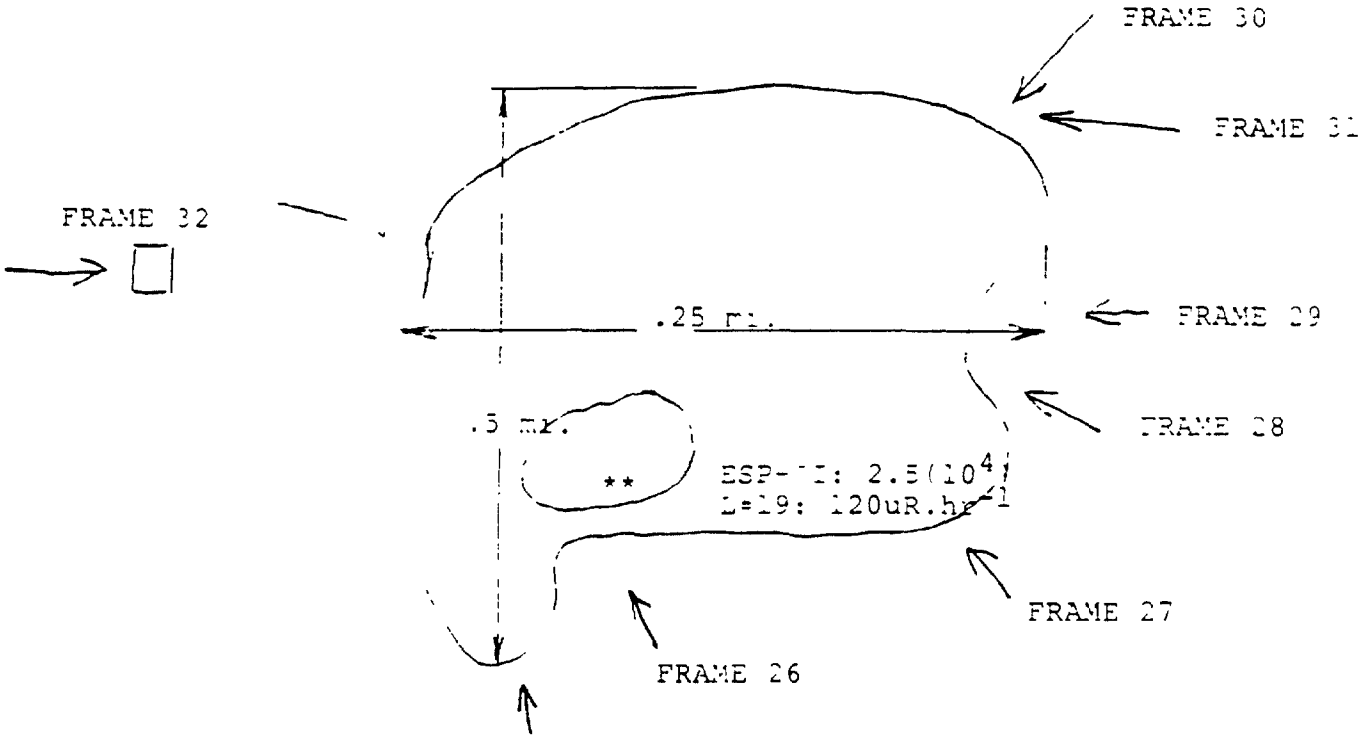
DATE APRIL 11,1990 **TIME** 11:15am **WEATHER** CLEAR TO SLIGHTLY OVERCAST

PHOTOGRAPHER P. MOLLOY **ANGLE/DIRECTION** -

FILM TYPE POLAROID **FRAME NO.** NO FRAME

DATA TAKEN WITH PHOTOGRAPH: SKETCH

1. Soil Sample ( )
2. Surface Water Sample ( )
3. Air Monitoring Device ( )
   Reading: _____
4. Radiation Survey (X)
   Reading: SEE BELOW
5. Deep Well Water Sample ( )
6. Photograph Below: *** NONE ***



* RADIOMETRIC READINGS ASSOCIATED WITH FRAME 27

7. **DESCRIPTION** SKETCH OF AREA WHERE RADIOMETRIC READINGS WERE TAKEN, NO SCALE

a windshield survey indicate that a substantial fraction of ¼ of a section (160 acres) is contaminated with mine tailings. Tailings piles, the incined adits and the timbered shaft are unfenced and readily accesible to site residents (3). There is no documentation of emergencies, accidents or remedial action regarding the Brown Vandever Uranium mine site.

3. WASTE CONTAINMENT/HAZARDOUS SUBSTANCE

An estimated total of 532,000 tons of mining waste is present in the two major tailings piles on site (4). Computations indicate that there are approximately 1880 tons of toxic compounds and elements dessiminated within the 532,000 tons of rubble at the site (3; Frames #8, #13, #15, #19, #25 through #32, 4). These contaminants are exposed and uncontained and are therefore capable of producing leachate subject to migration into atmospheric, ground water and surface water systems (11, 22, 23, 24, 25). The exposed inclined adits, timbered shaft and stopes may also be producing a leachate similar in composition to that produced by the tailings piles.

Specific radioactive species contributing to contamination of the leachate are uranium (U^{235}, U^{238}), and its daughter products Ra^{226}, Th, isotopes of Pb, Bi^{214}, etc). The enclosed portions of the adits and shaft may contain significant concentrations of Radon gas. Toxic heavy metal species suspected of being present in the mining waste in significant concentrations are Vanadium, Arsenic, Barium, Chromium, Magnesium, Manganese, Strontium, Titanium and Zirconium. Table 1 provides a summary of hazardous substances potentially present in the waste piles and in the open excavations.

4. PATHWAY CHARACTERISTICS

A. AIR CHARACTERISTICS

The potential for mobility of hazardous and toxic compounds associated with U_3O_8 and V_2O_5 mining waste is high due to the particulate nature of the waste and the occasional high winds native to the area which may cause migration of windblown contaminants offsite.

B. GROUNDWATER CHARACTERISTICS

Regionally, the site is bounded on the north by the central San Juan Basin and on the south by the Zuni uplift. Structural elements of the Acoma Sag lie southeast of the site (5;pgs 16,18:6). The geological element where the site is located is termed the Chaco slope (5;pg 16).

"Kelley (1951, p. 126) describes the Chaco slope as the southern part of the San Juan Basin that lies between the central Basin (fig. 2.5 -1) and the Zuni uplift and Acoma Sag. The Chaco slope resembles the platforms but differs from them because of "Its more pronounced and continous regional inclination toward the center of the basin and by the absence of a 'Monocline' separating it from the central basin " (Kelley, 1951, p.126).

Jurassic rocks from the Morrison formation and Chinle formation (which

TABLE 1. Quantity of Undisseminated Toxic Compounds and Elements Within Tailings Piles at Brown Vandever Uranium Mine

	Waste	Quantity of Undisseminated Hazardous Waste*	Disposal Location	Origination
-.	U_3O_8	6.35 ·10 ›kg	On-Site	Low Grade Uranium/ Vanadium
-.	V_2O_5	1.04 ·10 Kg	On-Site	"
3.	Radium	Unknown	"	"
4.	Thorium	"	"	"
5.	Arsenic	"	"	"
6.	Selenium	"	"	"
7.	Radon	"	"	"
	TOTAL	**1880 tons**		

* CUSTOMARY UNITS FOR REPORITNG ABUNDANCES OF RADICISOTOPES ARE MASS UNITS.

locally includes the Moenkopi formation) dip westwardly into the adjacent Chaco slope (3; frame# 20 and enlargement: 6:8). A Cretaceous sequence is present adjacent to the site on Haystack mountain and is represented by the Dakota sandstone exposure (3: frame #20 and enlargement). Triassic units represented by the Moenkopi and Chinle formations dip eastwardly into the adjacent Chaco slope (3;frame #20 and enlargement Figure #3).

Quaternary Alluvium (Pleistocene) has accumulated in variable thicknesses in streambeds in the area (32).

The Aquifer of concern in the Vicinity of the site is the Sonsela Sandstone member of the Chinle formation which sources the Navajo Nation Water Resources Division (NNWRD) well #16T-551 (19). Depth to water in ths well is documented and is reported to be 417 feet (circa 1976). Depth to the Sonsela sandstone member of the Chinle formation is 1083 feet. The only other Aquifer known to source wells in the area is the Entrada Sandstone (19). the net precipitation for the locale is estimated to be minus 44 inches (5, 12).

Contaminants of concern present in the tailings piles are the radiospecies U^{238}, U^{235} and their progeny Th^{232}, Bi^{214}, Po^{214}, isotopes of Pb & Radon gas. Toxic heavy metal species suspected of being present in the mining waste in significant concentrations are Ar, Ba, Mg, Mn, Sr, Ti and Zr. (11, table 1). Many of these species have been demonstrated by various authors to be mobile in waters associated with Uranium mines (23,24,25,26,27,28 and 29). The Hydraulic conductivity of the formations between the Alluvium and the Sonsela sandstone member is estimated to be of the order of 10^{-3} because of fractures and faults. This is consistent with the close proximity of the El Tintero Cinder Cone and the epochal geological development of the area. In addition, at least three excavations are driven to within 100 feet of the static water level in NNWRD well #16T-551. It follows that the possibility exists for these Radioactive and toxic heavy metal species to have migrated into the alluvial and Sonsela sandstone Aquifers which source an Artesian spring and NNWRD well #16T-551, respectively (3; frame #35: 19). Water depth in the alluvial Aquifer is not known but is expected to be shallow (5; pg. #40, fig.#4.3-1)

C. SURFACE WATER CHARACTERISTICS

A portion of the Brown Vandever mine site is located on a southeastwardly dipping Alluvial plate (3;frame #8) whose upgradient drainage area is estimated to be approximately 59.1 acres (4; worksheet #1). The stripmine portion of the site is located on a northwardly dipping Alluvial plate whose upgradient drainage area is estimated to be 14.23 acres (4; worksheet #1). Surface runoff from the 59.1 acre portion proceeds overland and along minor drainages eastwardly (3;frame,#16') until encountering a well-defined drainage which trends southeastwardly,(3;frame #17,#18). Surface runoff from the 14.23 acre portion proceeds overland and along minor drainages eastnortheastwardly (3;frame#31) until encountering the well-defined drainage which trends southeastwardly (7). The drainage proceeds southeastwardly for approximately 4 mi. before becoming evanescent (7, 31). Data from a gauging station on the Rio San Jose at Grants, New Mexico indicates an

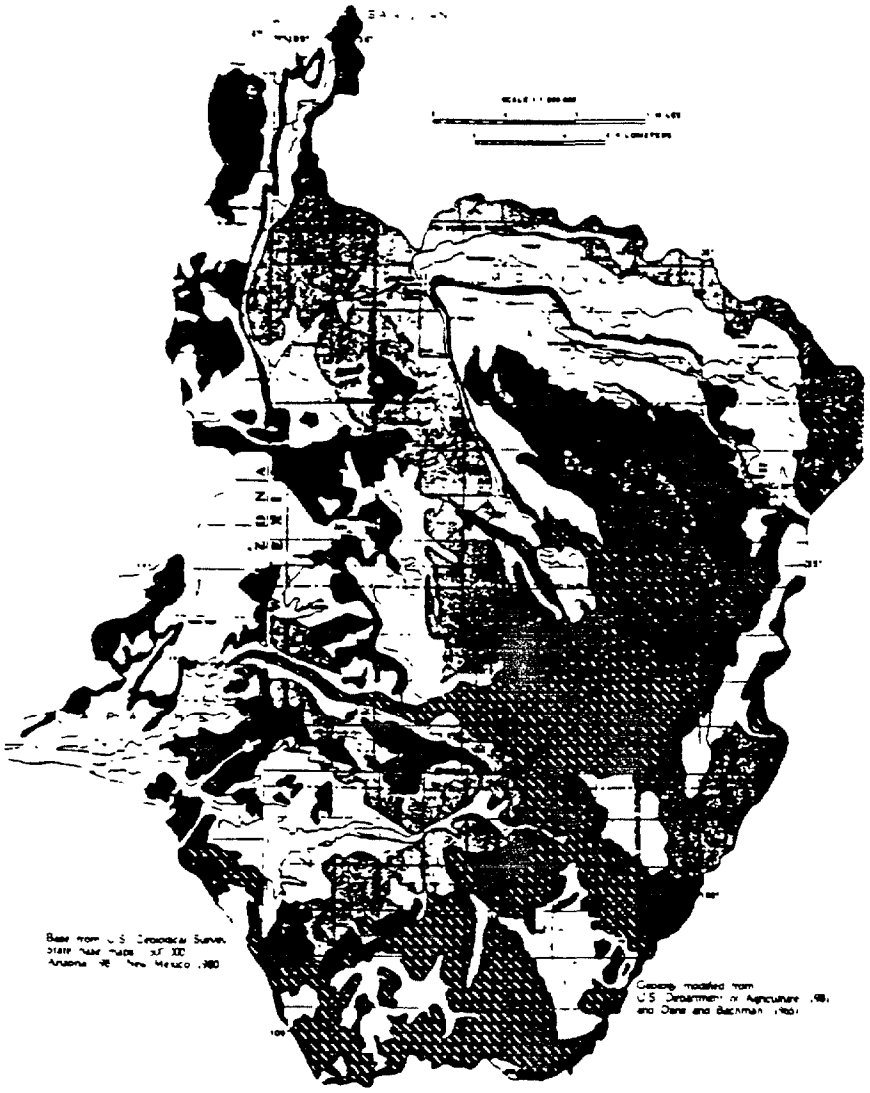


Figure 2-1 Generalized geologic map

EXPLANATION

QUATERNARY AND TERTIARY	ALLUVIUM AND BOLSON DEPOSITS
	IGNEOUS ROCKS, INCLUDES BASALT FLOWS, VOLCANIC BRECCIA, TUFF AND CINDERS, AND EXPOSED INTRUSIVE IGNEOUS ROCKS
TERTIARY	SEDIMENTARY ROCKS INCLUDING BIDAHOCHI FORMATION, CHUSKA SANDSTONE, AND BACA FORMATION
CRETACEOUS	MESAVERDE GROUP
	MANCOS SHALE AND DAKOTA SANDSTONE, UNDIVIDED
JURASSIC	MORRISON FORMATION, ZUNI SANDSTONE, AND SAN RAFAEL GROUP, UNDIVIDED
JURASSIC AND TRIASSIC	GLEN CANYON GROUP
TRIASSIC	CHINLE FORMATION; LOCALLY INCLUDES MOENKOPI FORMATION
PERMIAN	SAN ANDRES LIMESTONE AND GLORIETA SANDSTONE IN NEW MEXICO, DE CHELLY SANDSTONE IN ARIZONA, AND THE YESO AND ABO FORMATIONS IN NEW MEXICO
PERMIAN AND PENNSYLVANIAN	SUPAI FORMATION
PRECAMBRIAN	PRECAMBRIAN ROCKS, UNDIVIDED

FIGURE = 3 ; REGIONAL GEOLOGY,
AFTER USGS, HYDROLOGY OF REGION 62

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NAVAJO-BROWN VANDEVER URANIUM MINE

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annual discharge rate of 2.97 cfs (20). The regional 1-yr, 24-hr rainfall event for the locale is 1.26 inches (13). Radioactive and toxic heavy metal species have been shown to be mobile in surface waters (23 throught 29). In particular, Arsenic and Selenium are known to sorb strongly to surface water sediments (26,28). The possibility exists for contaminated sediments to have been carried by flasn floods, over the decades, onto the Alluvial plain east of El Tintero cinder cone (figure #2,7). A slight possiblilty exists for contaminated sediments to have been carried into Bluewater creek and the Rio San Jose (5,7). The area has not been mapped in a flood plain, However, due to the arid nature of the upgradient terrain and the general topography, the locale is prone to flash flooding events. Moreover, Haystack Mountain is very likely to be a recharge zone for aquifers in the area (5;pg#38).

D. ON SITE PATHWAY

As with other mines in the area the proto-ore was abandoned on-site. In the case of the Brown Vandever Mine, some of it was used to pave a haulage road which is used by site residents frequently (3;frame#22). The Brown Vandever mine environs are readily accessible by site residents and visitors to the area (3). There are no access barriers or danger signs on or near the mine site (3). Direct contact with contaminated particulates is possible during periods of high winds or physical disturbance of the tailings material. Humans living on-site and visitors to the area would are at risk to exposure from the same suite of radiospecies and heavy metals detailed above. Moreover, the ventilation shafts, the almost vertical timbered shaft and the inclined adits pose physical danger immediately dangerous to life and health status.

5. TARGETS

GROUND WATER TARGETS. There are three active wells within the 4 mile radius of influence of the site (19,21). The Indian Health Service (IHS) completed installation of a community Water System in October 1986 (21). Subsequent to the completion of the water system, operation and maintenance of the system was turned over to the Navajo Nation and is currently under the purvue of NNWRD (19). The community water system utilizes well #16T-551 which was formerly a livestock water well. The water system serves approximately 430 persons in the Haystack area (4;worksheet #2). Total population within the four mile radius of influence of the site was estimated to be approximately 500 (4;worksheet#2): The percentage of area residents not connected to the NNWRD water system was estimated to be 23% (=100 persons) on the basis of a residence count and the fact that 43.8% of Indian homes had their source of water more than 100 yds from their residennce (3,18,31). Area residents too indigent to afford plumbing and sewerage systems for their residences might utilize water from the active NNWRD stockwells #16T-522 and # 16T-521 (19,3;frame#41,18;pg.#1). In addition, there is at least 1 artesian spring in the immediate vicinity of the site (7;Bluewater Quad, 3;frame #35). There is a slight possibility that this spring could be utilized for drinking water.

The Aquifer of concern in the area is the Entrada sandstone unit which

sources windmills possibly utilized for potable water by as many as 100 persons (4;worksheet#2,18;pg.#1,3;frame#41). Depth to the water table in this confined unit is reported to be approximately 400 feet (19). As pointed out before, the shaft and inclines have been driven to within 100 feet of this aquifer. Targets in the area consuming groundwater from the Entrada sandstone unit are at risk to exposure from Radionucleides and heavy metals (II).

SURFACE WATER TARGETS Surface water targets would be potentially exposed to the same suite of Radionucleides and heavy metals that is the case with ground water targets. Risk of exposure may be low due to the low value for net precipitation for the area. However, extreme conditions brought in the area would inundate the highly eroded haulage road (18).

The well-defined drainage coursing first east and then southeast from the site crosses at least one federally designated wetland (9).

AIR TARGETS Humans living on site are being exposed to elevated Radon concentrations.

ON-SITE TARGETS In addition to being exposed to elevated Radon concentrations, residents of the Brown Vandever mine environs are confronted daily with the dangerous inclines, shafts and the insult to their land.

SENSITIVE ENVIRONMENTS At least one federally designated sensitive environment lies within 1 mile of the site.

6. OTHER REGULATORY INVOLVEMENT

PERMITS: No permit was found for the Brown Vandever Uranium mine

STATE AGENCIES: None

OTHER FEDERAL PROGRAMS: None

7. CONCLUSIONS AND RECOMMENDATIONS

The Brown Vandever Uranium mine site is exceptionally dangerous. However, no steps toward remediation or mitigation have been undertaken over the two and one half decades since cessation of activities. To assert that residents of the site have not been adversely affected by the insult to their land and very possibly their health is inadmissable.

Immediate action should be taken.

Reference List

Reference No.

1. Molloy, P., February 26, 1990. EPA Potential Hazardous Waste Site Identification for Brown sic' Uranium Mine, Bluewater, NM

2. New Mexico Bureau of Mines, 1983. Open file report OFR - 183. Uranium and Thorium occurrences in New Mexico: Distribution, Geology, Production and Resources.

3. Molloy P., April, 1990. Population, Population distribution, water usage and radiation survey for Haystack community.

4. Molloy, P., May, 1990. Mine Spoils calculations for the Brown Vandever Uranium Mine; worksheet for upgradient drainage area calculation; worksheet for population estimate.

5. United States Geological survey (USGS), April, 1984. Hydrology of area 62, Northern Great Plains and Rocky Mountain Coal Provinces, Colorado and New Mexico (open-file Report 83-698). Excerpts.

6. New Mexico Bureau of Mines and Mineral Resources, 1974. Geologic Map of Grants Uranium Region.

7. USGS 7.5 Minutes Topographic Maps: Bluewater Quadrangle, 1957; Ambrosia Lake Quadrangle, 1957; Goat Mountain Quadrangle, 1957; Prewitt Quadrangle, 1963; Thoreau NE Quadrangle, 1963; Dos Lomas Quadrangle, 1957.

8. New Mexico Geological Society, 1977. Guidebook of San Juan Basin III: Stratigraphic nomenclature chart and Haystack environs field notes (Excerpts).

9 US Fish and Wildlife, 1984. National Wetlands Inventory for Grants, New Mexico.

10. De Voto, Richard H. March, 1978. Uranium Geology and Exploration; Colorado School of Mines, Golden Colorado

11. Hilpert, Lowell S., 1969. Uranium Resources of Northwestern New Mexico (Geological Survey Professional Paper 603).

12. Becker, Dr. Robert, 1985. Preliminary Average Annual Lake Evaporation for the Navajo Reservation in inches of Water.

13. 40 CFR Parts 190 to 299, July, 1987. Protection of the Environment; 1-year 24-Hour Rainfall (incnes).

14. Molloy, P., April 11, 1990. Field Notes for Haystack Community Field Reconnaissance.

15. Eberline, December, 1987. Radiation Protection Catalog: Instrumentation specification Excerpts.

16. Contact Report, May 10, 1990. To: Mike Holona, Ranger, Navajo Fish and Wildlife. From: Patrick Molloy, Health Physicist, Navajo Superfund Office. Re: Fisheries, Hunt Units and Recreational areas in Haystack Mountain Area.

17. Contact Report, 1989. To: Fish Hoon, Geologist, Navajo Nation Minerals Department. From: Patrick Molloy, Navajo Superfund Department. Re: Leases-Navajo Lands Uranium Mines.

18. Molloy, P., May, 1990. Field Notes for Haystack Community Reconnaissance.

19. Navajo Nation Water Resources Division, Various Dates. Pertinent Excerpts from NNWRD Water Well Records.

20. US Geological Survey Waterdata Report NM-88-1, 1988. Water Resources Data for the Rio San Jose at Grants, New Mexico.

21. US Department of Health, Education and Welfare, Indian health Service, June, 1978. "As Built" Water System for Haystack, Navajo Nation, New Mexico.

22. CRC Press, 1989. Handbook of Chemistry and Physics.

23. The Merck Index, Tenth Edition, 1983. Windholz, M. ed., Merck and company Inc., Rathway, N.J.

24. Groundwater Prospecting for Sandstone-Type Uranium Deposits: A Preliminary Comparison of the Merits of Mineral-Solutions Equilibria, and Single-Element Tracer Methods, D. Langmuir and J.R. Chetham, May 1980.

25. The Thermodynamic Properties of Radium, Donald Langmuir, Department of Chemistry and Geochemistry, Colorado School of Mines, Golden Colorado, and Riese, Arthur C., Atlantic Richfield Company, Corporate Technology, Los Angeles, CA., April 1985.

26. Geochemistry of Selenium: Formation of Ferroselite and Selenium Behavior in the Vicinity of Oxidizing Sulfide and Uranium Deposits, Howard, J. Hatten, III., Department of Geology, University of Georgia, Athens, GA., July 1977

27. The Mobility of Thorium in Natural Waters at Low Temperatures, Langmuir, Donald, Department of Chemistry and Geochemistry, Colorado School of Mines, Golden, CO., and Herman, Janet S., Department of Geosciences, The Pennsylvania State University, University Park, PA., July 1980.

28. Agency for Toxic Substances and Disease registry (ATSDR) US

Public Health Service, March, 1990. Toxicological Profile for Arsenic (EXCERPTS).

29. ATSDR, Public Health Services, July 1989. Toxicological Profile for Chromium (Excerpts).

30. New Mexico Bureau of Mines and Mineral Resources, 1979. Open File Report OFR - 90. Descriptions of sections measured for Hydrogeologic study of the San Juan Basin, Northwest New Mexico

31. Navajo Nation, 1988. Navajo Nation Fax'88: A Statistical Abstract. Prepared by Technical Support Department, Window Rock, Navajo Nation, Arizona 86515.

32. Thaden, Robert E. and Ostling, Earl J. 1967. Geologic map of the Bluewater Quadrangle, Valencia and McKinley Counties, New Mexico.

33. US EPA, 1984. Uncontrolled Hazardous Waste Site Ranking System, Users Manual (HW-10).

34. Contact Report, May 29, 1990. To; Patrick Antonio, NSO Staff Hydrogeologist. From; Patrick Molloy, NSO staff Health Physicist. Re; Influence of faults in the Haystack area on Groundwater Hydrogeology (considered opinion).

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